PATENT SPECIFICATION

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650,891

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PROVISIONAL SPECIFICATION

Improvements relating to Torsional Vibration Dampers

We, THE BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED, of Nottingham Road, Loughborough, a British Company, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in torsional vibration dampers. Such dampers as applied to a rotating system such as an internal combustion engine air compressor reciprocating pump or other machinery liable to suffer from torsional vibration commonly comprise a housing rigidly attached to the rotating shaft and containing a fly wheel or inertia mass; the housing and fly wheel are separated by fine clearances, and the clearance space thus formed is filled wholly or partially with a suitable viscous fluid. The invention relates to vibration dampers of this type.

For two-stroke cycle engines of four to eight cylinders developing one hundred brake horsepower per cylinder at five hundred to seven hundred and fifty revolutions per minute and directly coupled to direct or alternating current generators a typical damper would comprise a cast iron or steel inertia member of 21½ inches outside diameter 12½ inches inside diameter and 3 inches thickness. This inertia mass floats inside a sealed housing with approximately 10 to 15 thousandths of an inch clearance this clearance space being completely filled with a viscous fluid such as a silicone fluid of viscosity 50,000 centistokes at 77 degrees Fahrenheit.

This inertia mass is approximately twice the inertia of one piston connecting rod and crankshaft element and balance weights if these last are fitted. In most cases the size of the damper inertia mass tends to be of this order for normal engines. It may be somewhat greater or smaller for special cases.

The dergree of damping can be varied in addition to varying the mass by changing either or both the viscosity of the fluid and the clearance between the mass and the housing.

When a system fitted with such a damper is running at or near resonance with a critical speed a large amount of energy may have to be dissipated by the damper; this energy appears in the form of heat so that the viscous fluid, and the whole of the damper may become warm or hot.

Since the viscosity of most fluids decreases as the temperature rises, the damper becomes progressively less efficient when running at or near resonance with a severe critical speed, and this loss of efficiency occurs even with synthetic fluids having an unusually small viscosity change, such as silicone fluids.

It is an object of the present invention to increase the efficiency of dampers of the type referred to by providing means to assist in dissipating the heat generated by them, whereby the upper limit of the operative temperature range is reduced. With this and other objects in view the present invention resides in providing dampers of the said type with fins, vanes, blades or the like which are formed on or connected to the side of the damper housing and/or its circumferential edge. According to a further feature of this invention means may be provided for causing a gaseous or liquid medium to flow through and or around the damper or part thereof to assist in dissipating the generated heat either in addition to or in lieu of the cooling fins.

In one method of carrying the invention into effect flanges or grooves may be cut into the periphery of the damper housing. The purpose of the flange is to increase the effective cooling surface area of the damper housing.

An alternative method is to attach curved blades to the sides of the damper

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housing. These blades are so shaped as to draw in air onto the side of the damper housing, somewhat in the fashion of an evacuator fin. If desired, a casing may be fitted outside these blades and shaped so as to form a duct or shroud. The purpose of this duct or shroud is to enable the air to be directed to the hottest parts of the damper. The shroud or duct may be either attached to the housing and rotate with it or it may be stationary, in which case it may conveniently be fixed to the engine mounting.

Yet a further alternative method of carrying the invention into effect is to encase the damper within the engine mounting in which case, the damper may be cooled by the engine lubricating oil, which oil is kept relatively cool by the engine cooling system.

As an alternative to the previously described embodiments of the invention, means may be provided for causing a gaseous or liquid media to flow around the damper. This may be brought about by locating the damper either inside or outside the engine mounting.

An example would be a damper on the front of a motor-car engine where either with or without special finning the air flow from the radiator would tend to keep the damper temperature constant.

It will be appreciated what while a number of specific embodiments of the invention have been mentioned above any combination of the above mentioned embodiments may be used.

In order that the nature of the invention may be more readily understood reference will now be made to the accompanying diagrammatic drawings in which various embodiments of the invention are illustrated by way of example:—

Figure 1 is a sectional elevational view of one embodiment being a section on line B—B of

Figure 2 which is a section on line A—A of Figure 1.

Figure 3 is an elevational view of an alternative embodiment.

Figure 4 is a section on line C—C of Figure 3.

Figures 5 and 6 illustrate the application of a shroud to the construction shown in Figures 3 and 4.

Figures 7 and 8 are front and side elevational views of a further alternative.

Figure 9 illustrates the application of a shroud to the construction shown in Figures 7 and 8.

In the ensuing description like numerals are applied to like parts.

Referring firstly to the construction shown in Figures 1 and 2 the housing is represented at 1 and the fly wheel or inertia mass is represented at 2, the two parts being displaced from one another by a small space which is filled with a suitable fluid. Around the periphery of the housing a number of cooling fins 3 are provided such as by machining. These fins may be conveniently 2 inches deep and one eighth of an inch thick and there may be four fins equally spaced across the rim of the housing. In the construction shown in Figures 2 and 3 radial or curved vanes or plates 4 are formed on one face of the housing so that as the housing rotates these vanes function in substantially the same manner as the impellor of a centrifugal fan and cause an outward flow of cooling air over that surface of the unit on which they are provided. These vanes may conveniently be one inch high and there may be sixteen of them in all equally spaced.

Figures 5 and 6 show the application of a shroud 7 to the construction shown in Figures 3 and 4. It will be seen that the shroud is generally of cup shaped configuration being displaced a short distance from the periphery of the housing.

In Figure 5 the shroud is dished to conform to the general contour of the vanes in profile whereas in Figure 6 the shroud is not so dished.

In the construction illustrated in Figures 7 and 8 vanes or blades 8 are formed around the periphery of the housing and these vanes or blades may be either straight or helical as desired. As the housing rotates the vanes function in the same manner as an axial flow fan or impeller and direct a flow of cooling air over the periphery of the housing.

Figure 9 illustrates the application of a shroud 7 to the construction illustrated in Figures 7 and 8. The function of the shroud 7 in the constructions shown in Figures 5, 6 and 9 is to constrain the path of the cooling air; the shroud may be stationary, such as by being fixed to the engine mounting or may be mounted for rotation with the housing as desired.

In a still further embodiment (not illustrated) the damper is enclosed or embodied in the engine or part thereof in such manner that it is continuously immersed in or covered with engine lubricating oil, which oil is maintained at a substantially constant temperature by the engine cooling system.

As previously stated the invention may also be carried into effect by directing a cooling spray or flow of liquid or gaseous medium to or over the damper unit, irrespective of whether the damper is positioned inside or outside the engine casing. It will be appreciated that it is not infrequent in certain installations to provide a cooling spray or flow functioning to perform some

ancillary service and in this event the existing spray or flow may be direct to the damper unit for the purpose of cooling.

In conclusion it must be pointed out that the embodiments described and illustrated herein are merely by way of example and are not to be construed in a limiting sense.

It will also be appreciated that the various features of certain of the embodiments may be combined with one another.

Dated this 28th day of January, 1948.
ERIC POTTER & CLARKSON.
Chartered Patent Agents.

COMPLETE SPECIFICATION

Improvements relating to Torsional Vibration Dampers

We, THE BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED, of Nottingham Road, Loughborough, a British Company, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in Torsional Vibration dampers. Such dampers as applied to a rotating system such as an internal combustion engine air compressor reciprocating pump or other machinery liable to suffer from torsional vibration, commonly comprise a housing rigidly attached to the rotating shaft and containing a fly wheel or inertia mass; the housing and fly wheel are separated by fine clearances, and the clearance space thus formed is filled wholly or partially with a suitable viscous fluid. The invention relates to vibration dampers of this type.

For two-stroke cycle engines of four to eight cylinders developing one hundred brake horsepower per cylinder at five hundred to seven hundred and fifty revolutions per minute and directly coupled to direct or alternating current generators a typical damper would comprise a cast iron or steel inertia member of 21½ inches outside diameter 12½ inches inside diameter and 3 inches thickness. This inertia mass floats inside a sealed housing with approximately 10 to 15 thousandths of an inch clearance, this clearance being completely filled with a viscous fluid such as a silicone fluid of viscosity 50,000 centistokes at 77 degrees Fahrenheit.

This inertia mass is approximately twice the inertia of one piston connecting rod and crankshaft element and balance weights if these last are fitted. In most cases the size of the damper inertia mass tends to be of this order for normal engines. It may be somewhat greater or smaller for special cases.

The degree of damping can be varied in addition to varying the mass by changing either or both the viscosity of the fluid and the clearance between the mass and the housing.

When a system fitted with such a damper is running at or near resonance with a critical speed a large amount of energy may have to be dissipated by the damper; this energy appears in the form of heat so that the viscous fluid, and the whole of the damper may become warm or hot.

Since the viscosity of most fluids decreases as the temperature rises, the damper becomes progressively less efficient when running at or near resonance with a severe critical speed, and this loss of efficiency occurs even with synthetic fluids having an unusually small viscosity change, such as silicone fluids.

It is an object of the present invention to increase the efficiency of dampers of the type referred to by providing means to assist in dissipating the heat generated by them, whereby the upper limit of the operative temperature range is reduced.

With this and other objects in view the present invention provides a torsional vibration damper of the type referred to having members such as fins, vanes, blades or the like projecting outwardly from its housing part to increase the effective external cooling surface.

According to a further feature of this invention means may be provided for causing a gaseous or liquid medium to flow around the damper or part thereof to assist in dissipating the generated heat.

In one method of carrying the invention into effect flanges or grooves may be cut into the periphery of the damper housing. An alternative method is to attach curved blades to the sides of the damper housing. These blades are so shaped as to draw in air onto the side of the damper housing, somewhat in the fashion of an evacuator fin. If desired, a casing may be fitted outside these blades and shaped so as to form a duct or shroud. The purpose of this duct or shroud is to enable the air to be directed to the hottest parts of the damper. The shroud or duct may be either attached to the housing and rotate with it or it may be stationary, in which case it may conveniently be fixed to the engine mounting.

Yet a further alternative method of carrying the invention into effect is to encase the damper within the engine mounting in which case, the damper may be cooled by contact of the engine lubricating oil with the said fins or vanes or the like, which oil is kept relatively cool by the engine cooling system.

When a gaseous or liquid medium is caused to flow around the damper, this may be brought about by locating the damper either inside or outside the engine mounting. An example would be a damper on the front of a motor-car engine, where the air flow from the radiator would tend to keep the damper temperature constant.

It will be appreciated that while a number of specific embodiments of the invention have been mentioned above any combination of the above mentioned embodiments may be used.

The above and other features of the invention are set forth in the appended claims and are disclosed in the detailed description, given by way of example, of the particular embodiments illustrated in the drawings accompanying the provisional specification in which :—

Figure 1 is a sectional elevational view of one embodiment being a section on line B—B of

Figure 2 which is a section on line A—A of Figure 1.

Figure 3 is an elevational view of an alternative embodiment.

Figure 4 is a section on line C—C of Figure 3.

Figures 5 and 6 illustrate the application of a shroud to the construction shown in Figures 3 and 4.

Figures 7 and 8 are front and side elevational views of a further alternative.

Figure 9 illustrates the application of a shroud to the construction shown in Figures 7 and 8.

In the ensuing description like numerals are applied to like parts.

Referring firstly to the construction shown in Figures 1 and 2 the housing is represented at 1 and the fly wheel or inertia mass is represented at 2, the two parts being displaced from one another by a small space which is filled with a suitable fluid. Around the periphery of the housing a number of cooling fins 3 are provided such as by machining. These fins may be conveniently 2 inches deep and one eighth of an inch thick and there may be four fins equally spaced across the rim of the housing. In the construction shown in Figures 3 and 4 radial or curved vanes or plates 4 are formed on one face of the housing so that as the housing rotates these vanes function in substantially the same manner as the impeller of a centrifugal fan and cause an outward flow of cooling air over that surface of the unit on which they are provided. These vanes may conveniently be one inch high and there may be sixteen of them in all equally spaced.

Figures 5 and 6 show the application of a shroud 7 to the construction shown in Figures 3 and 4. It will be seen that the shroud is generally of cup' shaped configuration being displaced a short distance from the periphery of the housing.

In Figure 5 the shroud is dished to conform to the general contour of the vanes in profile whereas in Figure 6 the shroud is not so dished.

In the construction illustrated in Figures 7 and 8 vanes or blades 8 are formed around the periphery of the housing and these vanes or blades may be either straight or helical as desired. As the housing rotates the vanes function in the same manner as an axial flow fan or impeller and direct a flow of cooling air over the periphery of the housing.

Figure 9 illustrates the application of a shroud 7 to the construction illustrated in Figures 7 and 8. The function of the shroud 7 in the constructions shown in Figures 5, 6 and 9 is to constrain the path of the cooling air; the shroud may be stationary, such as by being fixed to the engine mounting or may be mounted for rotation with the housing as desired.

In a still further embodiment (not illustrated) the damper is enclosed or embodied in the engine or part thereof in such manner that it is continuously immersed in or covered with engine lubricating oil, which oil is maintained at a substantially constant temperature by the engine cooling system.

As previously stated the invention may also be carried into effect by directing a cooling spray or flow of liquid or gaseous medium to or over the damper unit, irrespective of whether the damper is positioned inside or outside the engine casing. It will be appreciated that it is not infrequent in certain installations to provide a cooling spray or flow functioning to perform some ancillary service and in this event the existing spray or flow may be directed to the damper unit for the purpose of cooling.

In conclusion it must be pointed out that the embodiments described and illustrated herein are merely by way of example and are not to be construed in a limiting sense. It will also be appreciated that the various features of certain of the embodiments may be combined with one another.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we

claim is :—

1. A torsional vibration damper of the kind referred to having members such as fins, vanes, blades or the like projecting outwardly from its housing part to increase the effective external cooling surface.

2. A damper according to Claim 1 wherein the said members project from the circumferential edge and/or from one side of the housing at or near said edge.

3. A damper according to Claim 2 having those members projecting from the circumferential edge formed integrally in the outer circumferential part of the housing.

4. A damper according to Claim 2 having those members projecting from the side either curved or straight and functioning to draw air onto the damper side.

5. A damper according to any of the preceding Claims having a casing or shroud fitted at the outside of the members in such manner as to form a passageway for directing or constraining air to flow over the hottest parts of the damper.

6. A damper according to the last preceding Claim wherein the casing or shroud is substantially of cup shape and having its base dished or flat.

7. A damper according to the last preceding Claim having the shroud rotatable by for example attaching it to the housing, or stationary by for example attaching it to the engine mounting.

8. A damper according to any of the preceding Claims, mounted either outside or within the engine mounting in such manner as to be cooled by a gas or liquid flowing around it.

9. A damper according to the last preceding Claim mounted inside the engine mounting in such manner as to be cooled by the engine lubricating oil which is itself kept cool by the engine cooling system.

10. A damper according to Claim 8 mounted at the front of a motor car engine or the like, in such manner that it is cooled by air flow from the radiator.

11. A damper substantially as described and illustrated with reference to Figures 1 and 2, or to Figures 3 and 4, or to Figures 5 and 6, or to Figures 7 and 8, or to Figure 9 of the drawings accompanying the Provisional Specification.

Dated this 27th day of January, 1949.

ERIC POTTER & CLARKSON,
Chartered Patent Agents.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1951. Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. per copy; by post 2s. 1d. may be obtained.

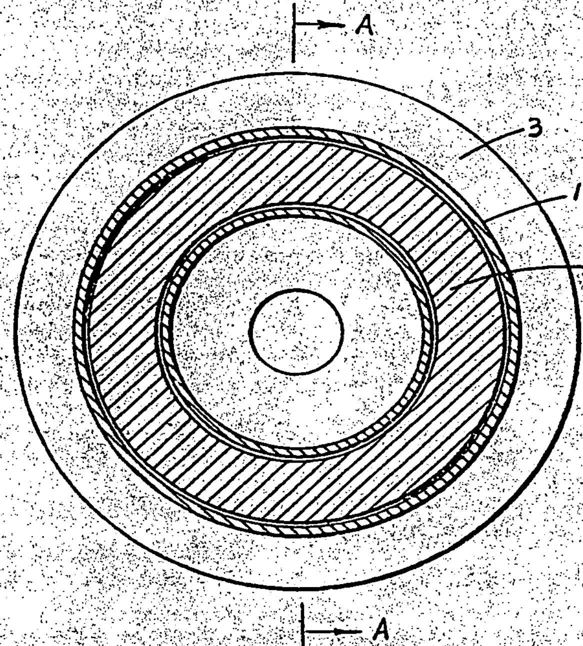


FIG. 1.

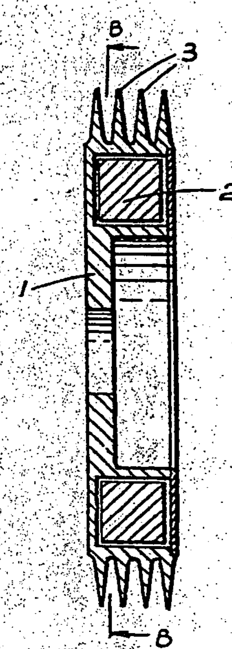


FIG. 2.

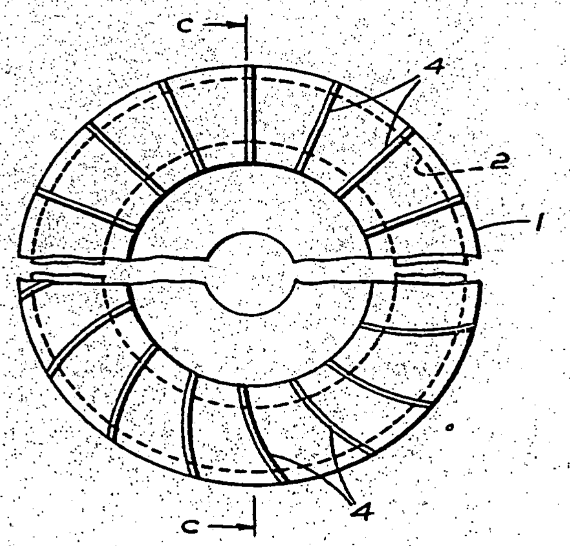


FIG. 3.

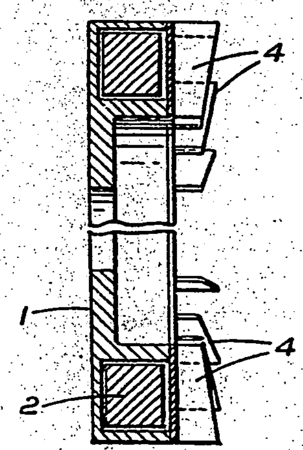
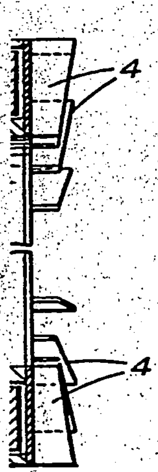


FIG. 4.

[This Drawing is a reproduction of the Original on a reduced scale.]

2.



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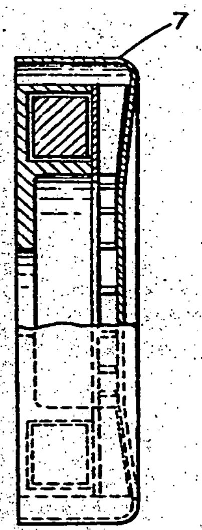

FIG. 5.

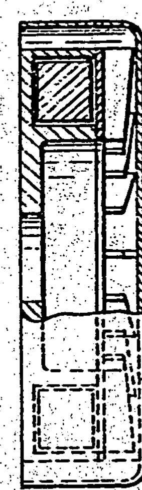

FIG. 6.

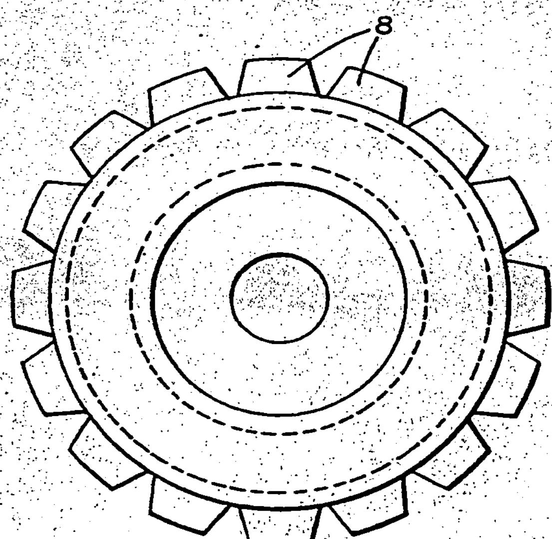

FIG. 7.

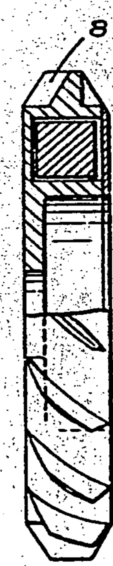

FIG. 8.

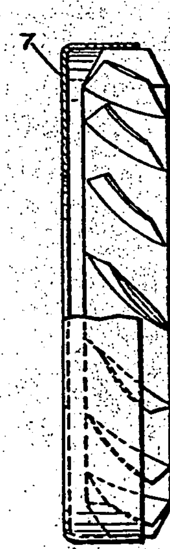

FIG. 9.

H.M.S.O.(Ty.P.)

650,891 PROVISIONAL SPECIFICATION

2 SHEETS

SHEET 1

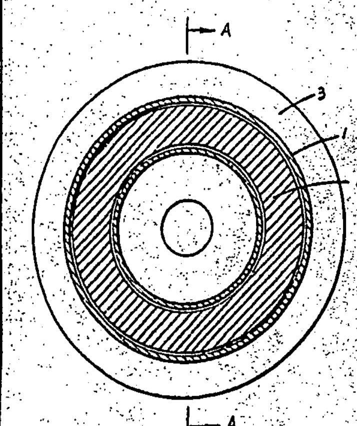

FIG. 1.

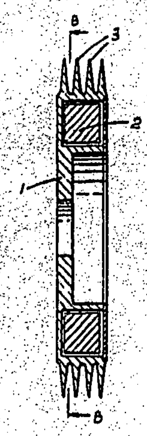

FIG. 2.

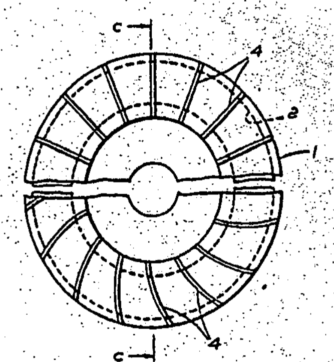

FIG. 3.

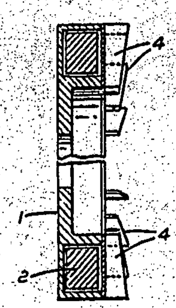

FIG. 4.

SHEET 2

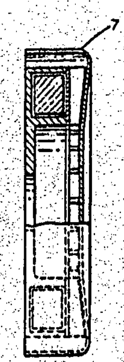

FIG. 5.

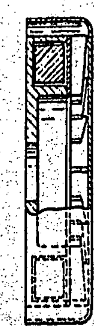

FIG. 6.

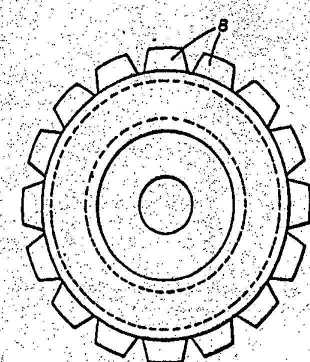

FIG. 7.

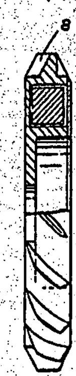

FIG. 8.

FIG. 9.

[This Drawing is a reproduction of the Original on a reduced scale.]

H.M.S.O.(Ty.P.)